

Remarks

Turning first to matters of form, we respectfully submit that the solicited claims, as amended, fully satisfy 35 U.S.C. §112. Claim 2 has been canceled, without prejudice and without disclaimer of the subject matter thereof. Accordingly, we respectfully request that the rejection under 35 U.S.C. §112 be withdrawn.

Claim 1 has been amended to clarify that it is the equilibrium sulfur soluble amount value of at least 80% of CaO-containing oxide inclusions having a particle diameter of $2\mu\text{m}$ or larger that is about 0.3wt% or less, and not the wt% of S as suggested by the Examiner. Support can be found throughout the Specification as originally filed, including pages 12-14 and original Claims 1-4. No narrowing amendments have been made and no new matter has been added.

Claim 3 and the Specification have been amended to correct minor grammatical errors. No new matter has been added and no narrowing amendments have been made.

Turning now to the merits of the invention, after conducting extensive research, the Applicants found that not every CaO-containing oxide inclusion causes the formation of CaS in areas surrounding the oxide inclusions in a Ca containing steel. The Applicants discovered that certain compositions of oxide inclusions actually create a situation in which the solubility of sulfur in the oxide is decreased, and further discovered that a solidification process conducted at a low temperature does not cause significant formation of CaS in areas around the oxide inclusions, effectively preventing future rust formation. (Specification, page 5, lines 5-18).

Based on this discovery, Applicants developed an improved Ca containing steel in which the equilibrium sulfur soluble amount value of CaO-containing oxide inclusions, particularly at least 80% of those having a particle size of $2\mu\text{m}$ or larger, are controlled to be less than about 0.03wt%.

We respectfully submit that the solicited claims are not anticipated by Kato. Kato discloses a method of producing molten aluminum-killed steel, in which metallic Ca is added to molten steel to produce a Ca content of about 0.0005 to 0.005wt%, and to satisfy $(\%Ca) \times (\%S)$ less than or equal to about 2×10^{-5} .

We note with appreciation the Examiner's comments and speculation that the steel sheet disclosed in Kato would inherently have the claimed amount of equilibrium sulfur soluble amount value for CaO-containing oxide inclusions. However, even if the base weight percent of sulphur in the steel sheet disclosed in Kato is 0.04wt% or less, this does not inherently or necessarily mean that the equilibrium sulfur soluble amount value in the oxide inclusions is less than 0.03wt%. In that regard, the MPEP is clear that a rejection based on inherency must demonstrate the such an inherent feature or characteristic must necessarily occur.

It does not necessarily occur in this case. This is factually demonstrated, for example, by Comparative Example 1 in the Specification, which contains only 0.010wt% of S, but includes an equilibrium sulfur soluble amount value in the CaO-containing oxide inclusions of 0.106wt% as seen at page 24, lines 1-6. This is further supported by the Declaration of Mr. Nabeshima enclosed herewith.

As discussed in the Specification, the equilibrium sulfur soluble amount in the CaO-containing oxide inclusions is determined not only by the weight percent of sulphur, but also by the Al and Ti used to deoxidize the steel sheet and the optical basicity of the oxide inclusions, as well as the casting temperature used during the continuous casting process. (Specification, page 12, lines 10, to page 14, line 19).

Kato nowhere even mentions the equilibrium S soluble amount value of the oxide inclusions at all, much less the need to control the amounts of Al and Ti during deoxidation, the optical basicity, and the casting temperature to achieve the claimed

amount of oxide inclusions. In fact, Kato nowhere even discloses the use of Ti. Accordingly, we respectfully submit that the facts on the record show the steel sheet of Kato would not inherently have the claimed equilibrium sulfur soluble amount value of CaO-containing oxide inclusions, and we request that the rejection under 35 U.S.C. §102 be withdrawn.

As noted above, it has been factually established that the weight percent of sulphur in the steel sheet is not inherently determinative of the amount of the equilibrium S soluble amount value of CaO-containing oxide inclusions in the steel sheet; it is only one parameter to be considered. While Kato teaches a relationship between the weight percent of sulphur and calcium, it nowhere teaches or suggests the controlling the amount of oxide inclusions, Al, Ti, the optical basicity and casting temperature as recited in the claimed mathematical formula.

In fact, Kato nowhere discloses the use of Ti at all or the optical basicity of the steel sheet. Accordingly, there is no teaching or suggestion in Kato by which one of ordinary skill in the art would be motivated to modify that steel sheet to achieve the claimed mathematical relationship, since critical elements of that relationship are nowhere even discussed in the reference.

We respectfully submit therefore that a prima facie case of obviousness has not been established.

Moreover, Example 1 and Comparative Example 1 in the Specification clearly factually demonstrate the improvements in rust resistance achieved in the claimed invention when this mathematical relationship is satisfied. As stated in the Specification on page 15, lines 5-20, the amounts of rust formation rapidly increases when the equilibrium S soluble amount of the oxide inclusions exceeds about 0.3wt%. The unexpected and significantly improved result is achieved by the claimed invention are further factually demonstrated by

Figures 1-4, which show the importance of meeting the claimed amount of oxide inclusions in the claimed mathematical relationship.

This is nowhere disclosed, taught or suggested in Kato. Accordingly, we respectfully request that the rejection under 35 U.S.C. §103 be withdrawn.

We note with appreciation the Yazawa, Nabeshima, and Nakato references disclosed by the Examiner. As with the Kato reference, these references all fail to disclose, teach, or suggest the claimed invention.

For the reasons set forth above, we respectfully submit that the solicited claims are clearly patentable over the prior art and are in proper condition for allowance, which action is respectfully requested.

Respectfully submitted,



T. Daniel Christenbury
Reg. No. 31,750
Attorney for Applicants

TDC/FAC:kb
(215) 563-1810

